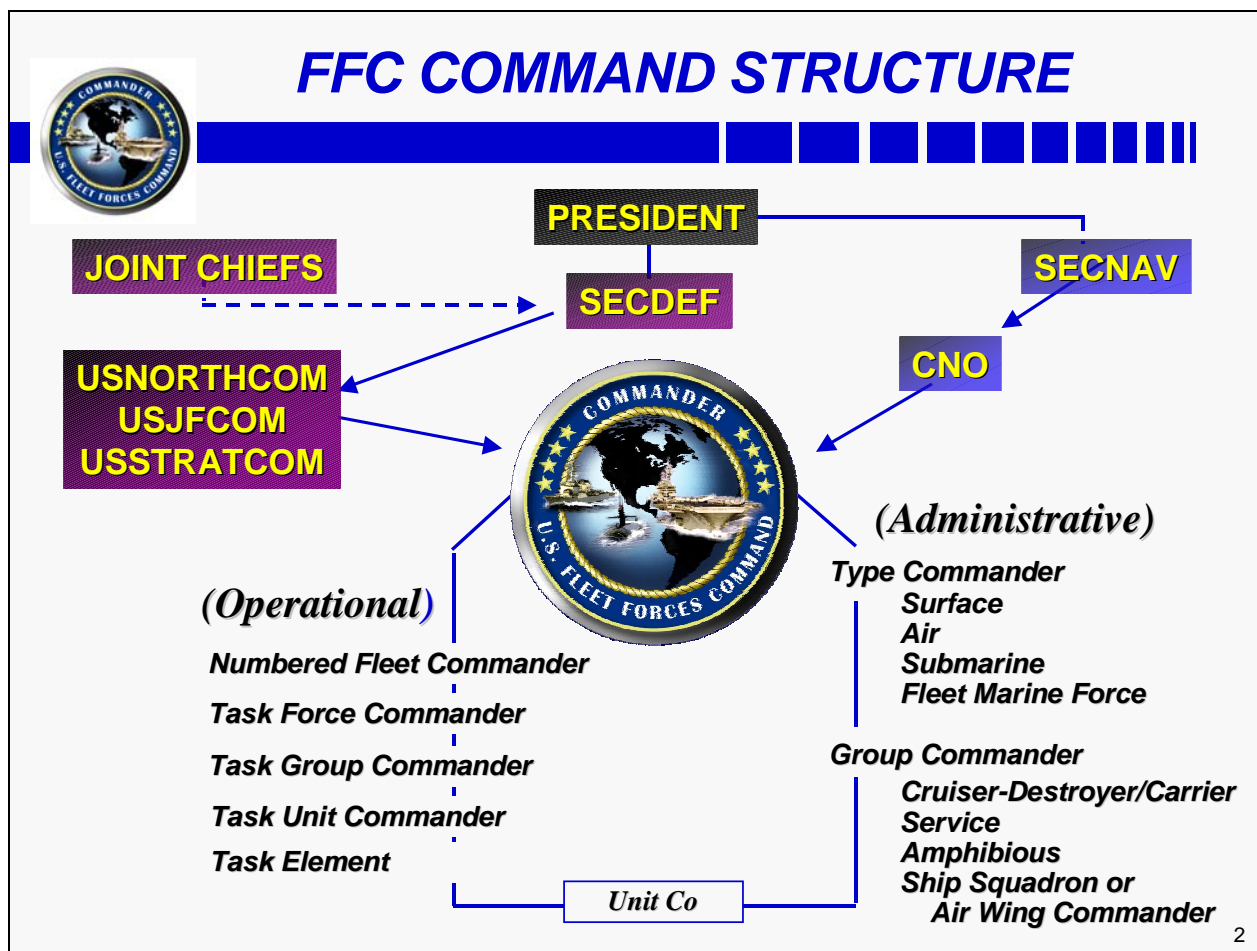# FLEET USE OF PRECISE TIME

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Abstract

This paper provides a perspective on current use of precise time and future requirements for precise time as they relate to individual shipboard systems, networks, satellite system, and clocks. It is based on studies performed by PMW 156 and others and upon recent demonstration of the use of Two-way Satellite Time Transfer (TWSTT) on USS Mount Whitney. Data are provided to show what kind of precise time standards and policies are in use today and how new timing architectures will provide cost-effective improvements in support of FORCEnet and other Navy and DoD initiatives that will require precise timing.

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FLEET FORCES COMMAND MISSION

Organize, man, train, and equip naval forces for assignment to Combatant Commanders.

Articulate Fleet war fighting and readiness requirements to the Chief of Naval Operations.

FLEET FORCES COMMAND VISION

• *Efficiently prepare active and reserve naval forces to win in combat*

• *Develop authoritative Fleet-coordinated readiness and warfighting requirements*

• *Explore transformational concepts; and*

• *Provide agile, powerful and persistent naval capability to Joint Commanders*

CARRIER STRIKE GROUP (CSG)

- ➢ **Power Projection**
- ➢ **Maritime Superiority**
- ➢ **Forward Presence**
- ➢ **Littoral Operations**
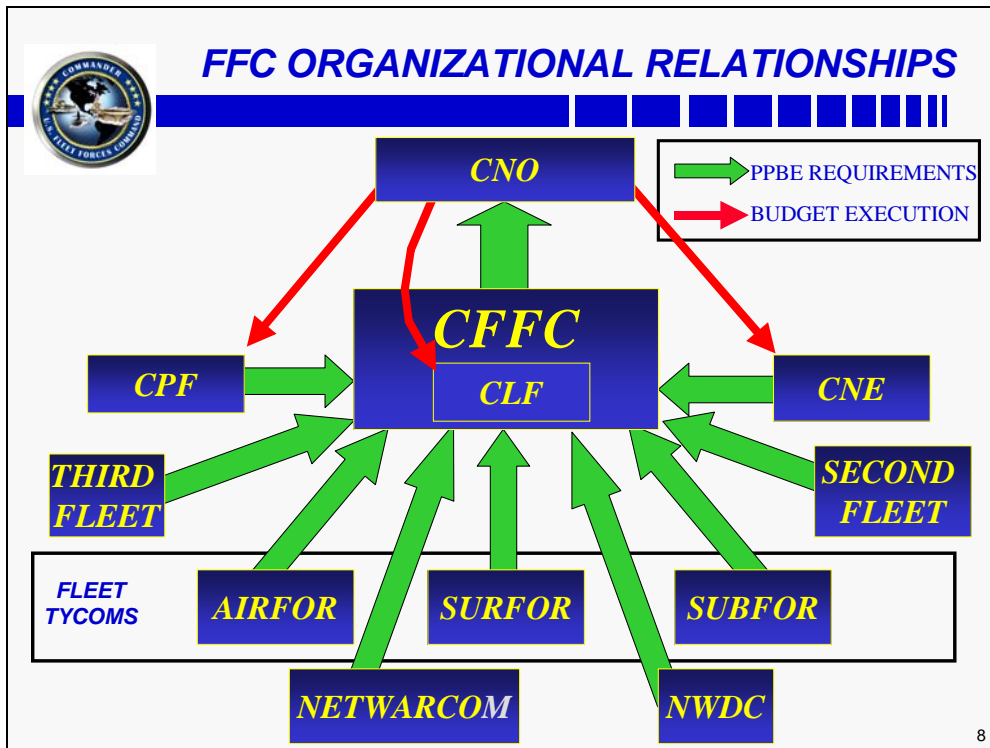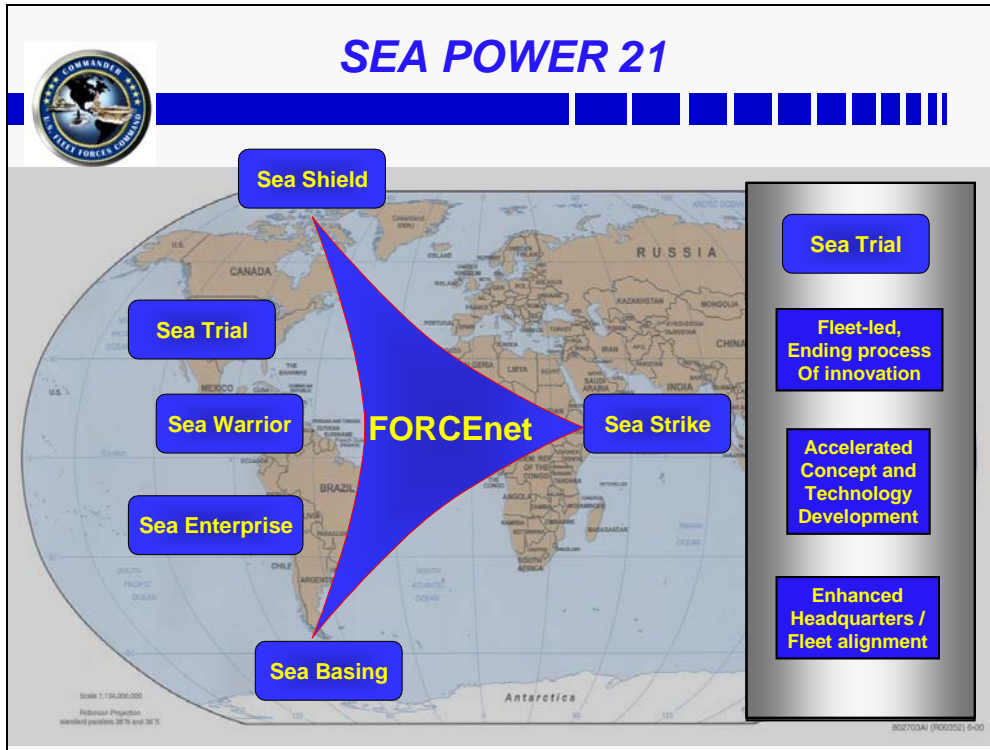- ➢ **Maritime Interdiction**

EXPEDITIONARY STRIKE GROUP (ESG)

- ➢ **Power Projection**
- ➢ **Maritime Superiority**
- ➢ **Special Operations**
- ➢ **Military Operations Other Than War**
- ➢ **Amphibious Operations**

FFC MAJOR FOCUS AREAS

Organizational Alignment
Establish FFC as the single fleet commander responsible for readiness and requirements

Current Readiness
Ensure high levels of fleet readiness and responsiveness by expanding and exploiting the Fleet Response Plan

Efficient Use of Resources
Incorporate the business dimension into planning and execution at all levels of command

Fleet-driven Requirements Process
A single, authoritative, coordinated Fleet-driven voice in the requirements process

Active/Reserve Integration
Structure, man, train and equip the Naval Reserve to better support Navy mission requirements

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FLEET USE OF PRECISE TIME

Minutes	**Ship clocks, watches, GCCS-M**
Seconds	**Celestial navigation**
Milliseconds	**Computer networks**
Microseconds	**Communications systems**
Nanoseconds	**Navigation, positioning systems, precise timing at timing labs**

USN/USMC PNT Policy ltr 27 June 00:

"Every platform/user with a validated requirement shall have a primary and least one alternative means of position and precise timing determination. The alternative must be independent of the the primary and may be a self-contained system."

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DOD USE OF PRECISE TIME

DOD Directive Number 4650.5 June 2, 2003

3.1 Procure cost effective airborne, land, sea and space PNT systems by taking advantage of existing military commercial systems whenever it may be done in a timely manner to meet military requirements.

3.2 Ensure that PNT systems support U.S. participation in allied and coalition operations to the maximum extent possible.

3.3 Cooperate with other Departments and Agencies in managing and overseeing dual-use PNT systems.

3.4 Maintain a level of PNT service consistent with both military and civilian requirements within affordable limits.

3.5 Ensure the protection of PNT services from disruption by forces adversarial to the United States, its Allies, and Coalition Partners while denying similar PNT services to those adversary forces.

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DOD USE OF PRECISE TIME

CJCSI 6130.01C dtd 31 March 2003

3a. Most timing requirements are based on a need for synchronization or coordination among cooperating units of a system or between systems…

The standard for military systems is UTC, as maintained by the USNO Master Clock, UTC (USNO).

3e. Ten nanoseconds (Objective, per GPS ORD) synchronized clock time is currently the most stringent timing requirement for DOD operational applications.

4e. TWSTT is available from USNO for high-precision PTTI. This procedure makes use of geostationary communications satellites to transfer time… one nanosecond time transfer is possible.

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FLEET USE OF TIME

➤ **Current trend is increasing use of GPS for time**

➤ **Timing requirements are not well known**

➤ **OPNAVINST 3120.32C Apr 94**

   "Ensure that chronometer comparisons are made to determine their rates and error, and that the ship's clocks are set to the local standard zone time or in accordance with the orders of the senior officer present.

➤ **COMNAVAIR/SURFOR 3540.4 26 Feb 02**

   "Ensure the ship's clocks/chronometers are properly maintained and set. Ensure time checks are passed throughout the ship before any special evolution and logged in the Ship's Deck Log."

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NAVY TIMING INITIATIVES

➤ **Timing requirements included in FORCENET plans**

➤ **SPAWAR/PMW 156 collecting Navy wide timing requirements: CEC, JTIDS, WSC-6, ACDS, BFTT**

➤ **CFFC ltr in support of Atomic Clock Vault at USNO**

➤ **TWSTT test conducted on USS Mt Whitney**

➤ **Timing architectures emerging: NAVSSI, TFDS, NCTAMS**

➤ **Fleet participation in OSD PNT S&T Working Group**

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QUESTIONS AND ANSWERS

JIM CAMPARO (The Aerospace Corporation): It looked like there are places that are taking care of the timekeeping requirements for the Navy. But is there any one organization or one group that is looking at interservice timekeeping requirements and allocations of timing requirements?

BILL BOLLWERK (for TOM MYERS): Well, actually, that is what the Naval Observatory is supposed to do in its role as PTTI manager. That is going to be reinstituted within a directive within OSD. It should be taking care of looking at all the services' timing requirements. We have been trying to do that over the last few years. We do have a database, which comprises some requirements from the Air Force, Army, Navy, and Marine Corps. We will continue to do that, so we keep that database. Dr. McCarthy is kind of in charge of that. If you have questions about that, please contact him.